

KLARTEXT

50 Years of TNC

Focus on the user:
From the TNC 110 in 1976
up to the current TNC7



DEAR READER,

Since 1976, TNC controls have been supporting people on the shop floor. From the very beginning, the objective was clear: to make machining work easier, more intuitive, and more direct. Technology should not create distance, but provide support where parts are manufactured, decisions are made, and responsibility is taken every day.

In this issue of KLARTEXT, we take a journey through time that looks back on nearly 50 years of development. It is also the story of how an idea evolved into a control strategy that has always been guided by the needs of its users and the people it was designed for. Nowhere is this more evident than in the workshop reports featured in this issue.

As users who work with TNC controls every day, you are in the best position to judge whether we have truly understood your requirements and continued to develop our control technology in line with your needs.

We look forward to shaping the future of manufacturing together with you.

YOUR HEIDENHAIN TEAM

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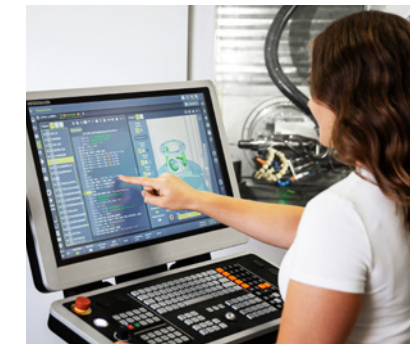
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50 YEARS OF PROGRESS

An idea that never stops

During this year's AMB, HEIDENHAIN is expected to deliver its 330,000th TNC control. This is an impressive milestone, and a fitting opportunity to look back.

In the early 1970s, HEIDENHAIN began exploring ways to make machine tools easier and more intuitive to operate. With the first microprocessors becoming available in 1973 and the company's proven position counters already in use, the first experimental controls were developed. Yet these early solutions were still too large, too complex, and too expensive for widespread adoption.

The decisive impulse came in 1976, when MAHO, based in Pfronten, Germany, approached HEIDENHAIN with a specific request. The machine manufacturer was looking for a compact, affordable control that would be easy to operate. Target positions needed to be entered directly and reached without unnecessary intermediate steps. From this requirement emerged an idea that would shape manufacturing for decades to come: the TNC.

1976 – 1977 / TNC 110 / TNC 120 / TNC 121

THE SHOP FLOOR GETS A MEMORY

In 1976, HEIDENHAIN began developing the first TNC control, the TNC 110. Although it did not yet feature program memory, it did already allow machining positions to be entered directly and approached on the machine. This placed greater emphasis on the expertise of machine operators while providing increased flexibility in production.

The successor model, the TNC 120, was the first to include program memory. Up to 64 program blocks could be stored and recalled for recurring machining operations.

The third TNC model, the TNC 121, followed as early as 1977. It featured a program memory capacity of 128 blocks. Additional commands for program section repeats and subprograms simplified machining operations and improved efficiency. What began as direct machine operation was evolving into a repeatable manufacturing process.

The best solutions arise when a technology benefits from the experiences of its users.



1979 / TNC 135

KLARTEXT COMES TO THE SHOP FLOOR

With the TNC 135, HEIDENHAIN introduced Klartext programming, making the programming process at the machine significantly easier to understand. Instead of relying on cryptic command sequences, clear conversational prompts guided users step by step through the required inputs.

At the same time, the TNC 135 was the first TNC control to feature a screen. This made operation clearer and more intuitive. In doing so, HEIDENHAIN set new standards while reinforcing a guiding principle: the control should support the person at the machine—clearly, directly, and in their own language. Today, HEIDENHAIN Klartext is available in more than 20 languages.

The control starts speaking the operator's language, clearly and directly on the shop floor.

1984 / TNC 155

WHAT'S BEING MADE BECOMES VISIBLE

The TNC 155 transformed program code into a graphical representation of the workpiece by bringing machining simulation to the screen. What had previously existed only as lines of program code could now be visualized as a part on the display. Users were able to follow the machining sequence more easily and verify programs before machining began.

In addition to conversational Klartext programming, the TNC 155 also supported program input in accordance with ISO 6983.

The TNC 155 made programs accessible in two ways: directly on the shop floor or externally, while allowing the machining process to be visualized before the first cut was made.



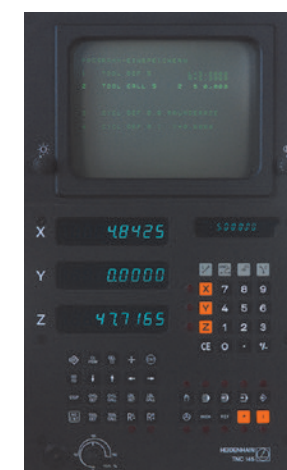
1981 – 1983 / TNC 145 / TNC 150

CONTOURS IN MOTION

At EMO 1981, HEIDENHAIN introduced the TNC 145, its first contouring control. For the first time, users could program even complex contours directly at the machine, supported by the familiar Klartext dialog. The machine no longer moved simply from point to point, but followed the entire contour.

Just two years later, the TNC 150 further expanded the capabilities of contouring controls, by supporting four axes and featuring an integrated PLC.

For users, this provided greater flexibility and more options when tackling demanding machining tasks.



Greater design flexibility makes the TNC even more versatile.

1987 / TNC 355

FREEDOM TO CUSTOMIZE THE OPERATING PANEL

With the TNC 355, HEIDENHAIN separated the keyboard from the logic unit. This gave machine manufacturers greater flexibility in designing the operating panels, so that they could be tailored more precisely to machines and their applications.



1994 / TNC 426

MACHINE AND CONTROL GROW TOGETHER

In 1994, HEIDENHAIN took the next step in system integration with the TNC 426: speed and current control loops were fully integrated into the control. As a result, the TNC took over all aspects of drive control. At the same time, HEIDENHAIN expanded its product portfolio to include drives and inverters.

Control, drive, and machine grew into a perfectly coordinated overall system.

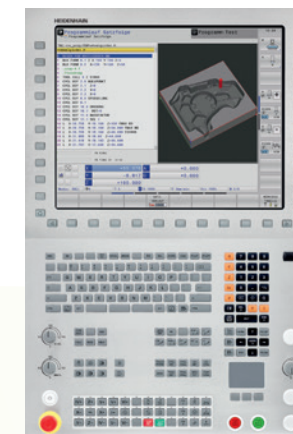
Milling and turning merged into a seamless process, practical for everyday use and performed directly at the machine.

2011 / TNC 640

THE TNC REDEFINED THE PROCESS AS A WHOLE

In 2011, the TNC 640 set new standards for done-in-one machining on a single machine tool. It made the switch between milling and turning practical for everyday production, combining operator convenience with the consistency of the TNC philosophy.

The control also ushered in a new generation of design. A premium stainless-steel housing, a large 19-inch monitor, and redesigned keys enhanced both clarity and operating comfort. Integrated LED indicators in the machine operating panel provided instant visibility of key machine conditions.



1989 – 1991 / TNC 415 / TNC 425 THE ADVENT OF DRIVES AND COLOR DISPLAYS

At EMO 1989 in Hanover, Germany, HEIDENHAIN introduced a new generation of controls: the TNC 415. Featuring 32-bit processors, a color display, and an alphanumeric keyboard, it offered greater performance, improved clarity, and a new level of operating convenience. At the same time, development of digital integrated drive control systems continued to advance. With the integration of the speed controller into the control and the introduction of the TNC 425, the benefits of digital speed control became available even with analog inverters.

The TNC started interacting more closely with the drive, marking the beginning of an increasingly tight integration of motion, control, and operation.

2001 / iTNC 530 CHIP-TUNING FOR THE CONTROL

At EMO 2001, HEIDENHAIN introduced the iTNC 530, ushering in a new era of TNC controls. Its completely redesigned hardware architecture continued the successful concept of TNC contouring controls while setting new standards in HSC machining.

Short block processing times and optimized motion control increased speed, precision, and dynamic performance. And for the first time, HEIDENHAIN separated the NC main computer from the controller unit.

Greater computing power brought higher workpiece accuracy and new dynamics to HSC machining.



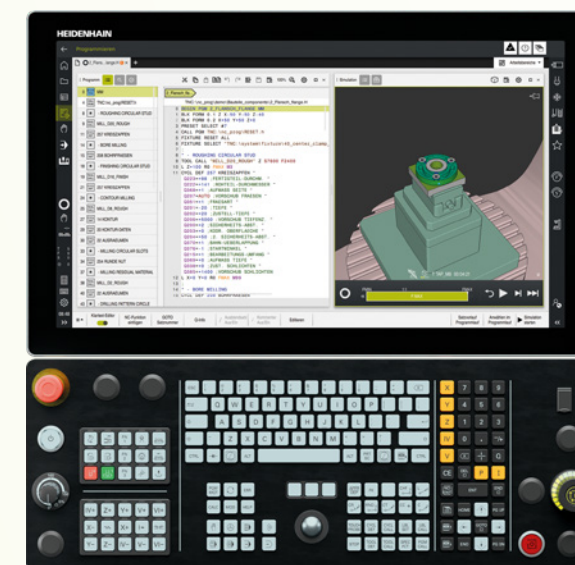
2021 / TNC7 THE FUTURE BECOMES TANGIBLE

In 2021, HEIDENHAIN introduced the TNC7, marking the beginning of a new generation of controls. The familiar Klartext programming concept remained at its core, complemented by graphical programming, touchscreen operation, and a consistently task-oriented user interface.

Users can customize their workspaces and access functions exactly where they are needed for each step of the job. The TNC7 supports the entire manufacturing process, from programming and setup to inspection of the finished workpiece. The graphical 6D setup capability makes this key process step much easier while increasing process reliability.

As the TNC7 family expands, so does the range of available solutions. Today, the portfolio extends from training applications and a wide variety of machine concepts to retrofit projects, offering a control tailored to virtually any application.

The TNC7 adapts to the task and the user's preferred way of working, not the other way around.



More info
on the history
of the TNC



“Most customers come to us when standard solutions reach their limits.”

Jürgen Bösch, Managing Director

TNC EXPERTS AT WORK AT BÖSCH FERTIGUNGSTECHNIK

When customers come to Bösch Fertigungstechnik with a problem for which neither drawings nor CAD data exist, the real work begins. One constant throughout the process is the company's exclusive use of HEIDENHAIN TNC controls. Drawing on decades of hands-on experience with the technology, Bösch relies on TNC controls to meet demanding requirements for flexibility and on-time delivery.

FROM A MANUFACTURING ORDER TO A COMPLETE SOLUTION

Bösch Fertigungstechnik's core expertise lies in machining sophisticated aluminum components. Large-scale production plays only a minor role. Instead, the company focuses on one-off parts and small batch sizes, often involving unusual requirements and tight deadlines.

One example from the confectionery industry illustrates the company's approach. A customer urgently needed a replacement component for candy production equipment after the lead time and cost quoted by the machine manufacturer had become unacceptable. The challenge was that neither technical drawings nor CAD data were available.

The Bösch team digitized the existing component directly on the machine using a touch probe and then created a CAD model from the collected data. The component was thus first recreated digitally and then in reality. In the process, the manufacturing specialists deliberately replaced the original cast design with a component machined from a solid aluminum block.

The change delivered an additional benefit. If a tooth on the component gets bent during cleaning of the candy-making machine, it can usually be straightened and re-used. With the previous cast version, similar damage often resulted in a fracture, requiring the entire component to be replaced. This example highlights the company's commitment not only to manufacturing parts, but also to developing effective technical solutions.

FLEXIBILITY AND ON-TIME DELIVERY

The keys to success



“For us, this wasn't a typical manufacturing job. We first had to understand what the component was supposed to do and how we could improve its design. Only then could the actual design work begin.”

Jürgen Bösch



“Machines and software are important. What really matters, however, is that the people using them understand their capabilities and know how to put them to use in practice. In my view, that combination of experience, expertise, and modern technology is the key to our success.”

Jürgen Bösch with his daughter Leonie and son Lukas. Both are actively involved in the business and are already helping shape the future of the family's company.

CAM-SUPPORTED MANUFACTURING WITH ROOM FOR FLEXIBILITY

Most NC programs are created using a CAM system and then transferred to the respective machine via TNCremo. Even so, programming directly with the control continues to play an important role in day-to-day operations.

Adjustments to dimensions, additional holes, and minor optimizations are often implemented directly at the machine. This flexibility is particularly advantageous when producing one-off parts and responding to last-minute changes.

EXPERIENCE THAT SPANS MULTIPLE TNC GENERATIONS

Christoph Wälde is one of the employees at Bösch Fertigungstechnik who, like Jürgen Bösch, can draw on many years of experience with HEIDENHAIN controls. Over the course of his career, he has worked with numerous generations of control technology, from early systems dating back to the Grundig era to today's TNC7. Together, the two have witnessed and helped shape

technological developments over several decades. They both cite the introduction of the iTNC 530 as a major milestone. Its performance capabilities opened up new possibilities, particularly in HSC machining. They view today's TNC7 as the logical next step in that evolution, with a strong focus on ease of operation and user-friendliness.

THE TNC7 IN DAY-TO-DAY PRODUCTION

With a DMG MORI DMU 95 monoBLOCK equipped with a TNC7, Bösch Fertigungstechnik has expanded its capabilities in 5-axis machining. The machine is used primarily for complex aluminum components featuring freeform surfaces and demanding requirements for precision and process reliability.

According to Christoph Wälde, one of the standout features is the modern user interface. Its structure follows familiar operating concepts, making it easy to customize workspaces to individual preferences. During program prove-out, multiple types of information can be displayed simultaneously, while the size and arrangement of the windows remain fully flexible.

SUPPORT WHEN PROVING OUT NEW PROGRAMS

The OC 310 override controller plays an important role in day-to-day operations.

“When proving out new programs, I want to keep my attention on the tool and the workpiece. The override controller helps me do that because it provides feedback about important settings directly, without requiring me to take my eyes off the work envelope.”

Christoph Wälde

The colored LED display provides information about the current setting, while vibration signals deliver additional feedback.

Users can also define stops before events such as tool changes or rapid-traverse movements. This provides greater control in critical situations and simplifies the validation of new programs. Another feature users appreciate is the ability to correct detected errors directly in the NC program from within the simulation, without having to switch operating modes.



“I’ve used almost every generation of TNC controls in practice. Over time, you develop a good feel for how the controls have evolved and which features really make a difference in everyday work.”

Christoph Wälde

Bösch Fertigungstechnik GmbH

Based in Teningen in southern Germany, Bösch Fertigungstechnik specializes in the production of complex one-off parts and small production runs. Fast response times, exceptional flexibility, and extensive manufacturing expertise shape the company's day-to-day operations.

Since acquiring the company in 2016, Managing Director Jürgen Bösch has continuously invested in expanding and modernizing the machine shop. The company's positive development continues, with plans to increase manufacturing capacity and invest in additional 5-axis technology. The foundation of this growth remains the combination of skilled employees, advanced manufacturing technology, and extensive control expertise.

A look at the shop floor makes it clear that productivity depends on more than machines alone. Success is driven by the interplay of experience, process expertise, and the ability to solve even unusual challenges quickly and reliably. That is precisely what sets Bösch Fertigungstechnik apart from the competition.

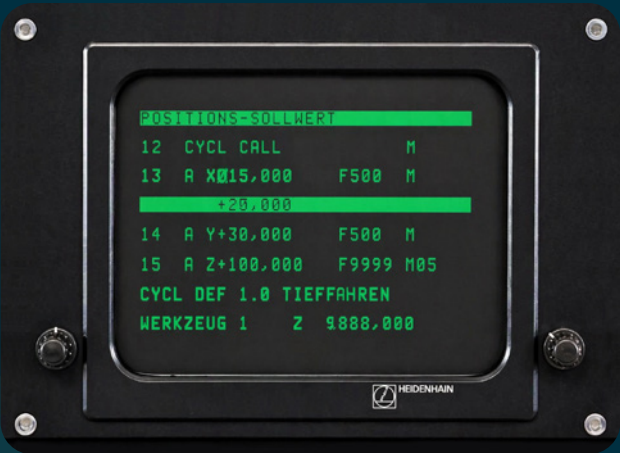
HEIDENHAIN
KLARTEXT –
The shopfloor language

The Klartext programming language from HEIDENHAIN has been the conversational programming language for TNC controls since the introduction of the TNC 135 in 1979. This language was specifically developed for shopfloor-oriented programming directly at the machine.

Instead of having to memorize complex G codes, users are guided step by step through the creation of an NC program with the help of clear prompts, instructions, and selection options.

Programming follows a structured approach: After defining the workpiece blank, the required tools are called, technology data is specified, and positioning movements are defined before machining of the workpiece begins. Contours can be described easily using linear and circular elements.

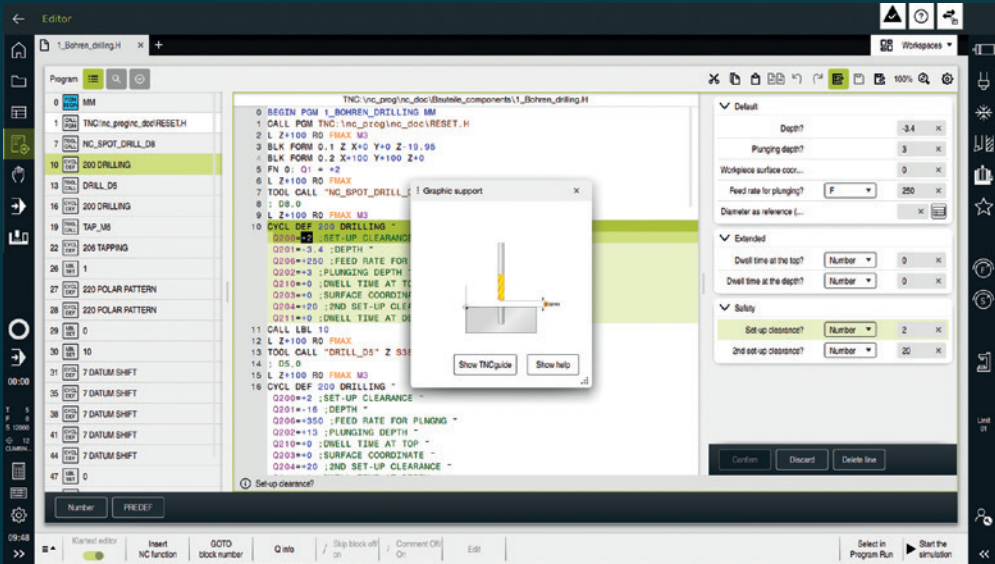
During program entry, the control continuously displays the appropriate cycles available for selection. Additional form-based views and graphical help screens simplify



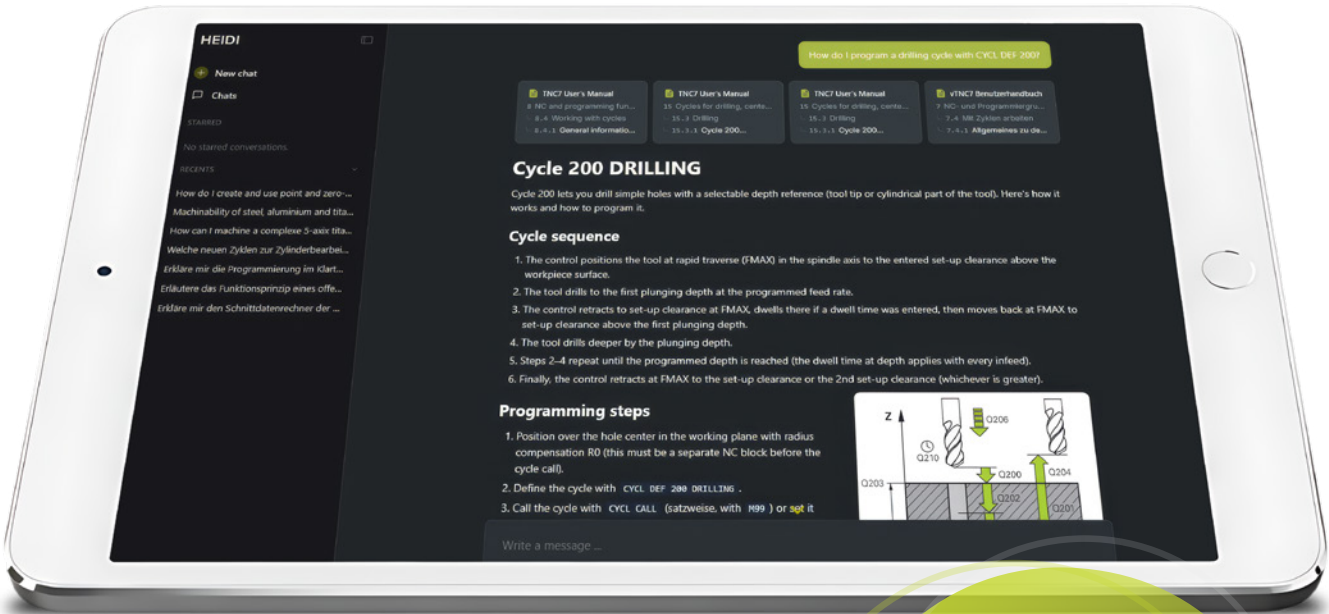
Klartext dialog on the TNC 135

parameter entry and help reduce programming errors. A clearly structured display with color coding improves program readability. Frequently recurring machining operations are available as predefined cycles, accelerating program creation.

Another major advantage is the long-term compatibility: Klartext programs are upwardly compatible and can usually continue to be used on newer generations of controls. By combining intuitive conversational guidance, graphical support, and practical shopfloor-oriented operation, HEIDENHAIN's Klartext programming language enables the fast, reliable, and efficient creation of machining programs.



Klartext dialog on the TNC7



Drawing on its extensive control expertise, HEIDI delivers precise and actionable answers.

HEIDI does not replace experience or personal responsibility. However, the AI assistant makes existing knowledge more readily accessible and significantly shortens the path from question to solution.

A QUESTION LEADS
TO AN NC PROGRAM
HEIDI makes HEIDENHAIN
know-how available at all times

Searching documentation, paging through manuals, or looking for similar NC programs: finding the right information often consumes valuable time in day-to-day manufacturing operations. With the new HEIDENHAIN DIGITAL INTELLIGENCE, commonly known as HEIDI, HEIDENHAIN offers an AI assistant that provides a direct path from question to solution. Users can formulate their questions in natural language and receive answers on machine operation, programming, and manufacturing technology. HEIDI also analyzes existing NC programs, explains their functions, and assists with adapting them to new requirements. Poten-

tial errors can be identified and corrected quickly, program modifications can be implemented automatically, and comments can be revised or translated as needed.

Following its introduction in the vTNC7, HEIDI will be available to all users for the first time at AMB 2026 via heidenhain.ai. It can be accessed directly at the machine, from a workstation, or on any mobile device with an internet connection. Saved chat histories ensure that questions, answers, and work results remain synchronized and available across all devices at any time.

More info
on HEIDI

10 YEARS

TNC Club

DEEPENING KNOWLEDGE, SHARING EXPERIENCE

Schunk Carbon Technology in Bad Goisern, Austria

Our visit takes us to the toolmaking department at Schunk Carbon Technology GmbH in Bad Goisern, Austria. The company joined the TNC Club way back in 2018, and enjoys its Premium membership. The TNC Club itself is now celebrating ten years of bringing the HEIDENHAIN community together.

The company's roots date back to 1946, when it was founded as Hoffmann & Co. Elektrokohle AG. It became part of the Schunk Group in 1999. Today, the Bad Goisern facility develops and manufactures carbon contact strips for power transmission in rail transportation, components for the automotive industry, and, increasingly, shaft grounding solutions designed to dissipate stray currents in e-mobility applications.

ADDED VALUE THROUGH TNC CLUB PREMIUM MEMBERSHIP

Christoph Schiendorfer and his team make active and regular use of the benefits offered by TNC Club Premium membership. The annual visit from regional TNC Club application expert Michael Wartbichler provides an opportunity to learn about software innovations and deepen their knowledge of specific control functions. In addition, employees regularly participate in regional user training events. Alongside technical presentations, the opportunity to exchange experiences and practical insights with fellow users is a particularly valuable part of these events.

TOOLMAKERS ENSURE HIGH MACHINE AVAILABILITY

With a team of 18 employees, the toolmaking department plays a key role at the Bad Goisern site. Whether producing tools at short notice or manufacturing spare parts for production equipment, its primary objective is to keep downtime to an absolute minimum. Since the production machines used at the facility are designed and built in-house, the toolmaking department is also responsible for creating numerous prototypes. Programming work is split roughly evenly between programming directly at the machine and programming via the CAM system or an external TNC programming station.



PROVEN TECHNOLOGY WITH IMPRESSIVE LONGEVITY

The toolmaking department brings together two generations, both of people and of machine technology. The HEIDENHAIN controls in use range from a TNC 355 dating back to 1990 to the modern TNC7, which has been in operation since 2024. Hubert Mitterhauser has been with the company since 1989 and has operated a HERMLE UWF 900 equipped with a TNC 355 since 1990. In more than three decades of service, only the monitor has had to be replaced. To this day, both the machine and the control continue to operate reliably and are used almost every day. Even this control, introduced in 1987, still provides all the functionality required for repairing production tooling and manufacturing prototypes for which no CAD model exists, thanks to features such as graphic program preview and integrated cycles. The machine's open design offers another advantage: long aluminum profiles that are often difficult or impossible to clamp in enclosed machines can be machined here without difficulty.

THE PATH TO 5-AXIS MACHINING

As the need for machining multiple sides of a workpiece continued to grow, 5-axis machining became an increasingly important topic. To evaluate its benefits and economic viability in the toolmaking department, the company initially opted for a used machine equipped with an iTNC 530, providing a cost-effective entry into the technology. Two years ago, the company also invested in a new machine featuring a TNC7, becoming the first HERMLE customer in Austria to operate a machine with the new control. The transition to the new generation of controls went smoothly. Following initial setup and OEM training, the annual visit from the TNC Club application expert was used to further deepen the team's knowledge and accelerate the familiarization process.

OCM CYCLES DRIVE PRODUCTIVITY

Toolmaker Fabian Schweizer works primarily on the TNC7. The OCM cycles for roughing and finishing, including the integrated cutting data calculator, are his personal highlight. The calculator assists users in determining optimal machining parameters and significantly reduces the effort required for manual calculations.



Two generations of machines and colleagues come together in the toolmaking department: Hubert Mitterhauser (left) and Fabian Schweizer (right) with Christoph Schiendorfer (center).



Hubert Mitterhauser: "As a toolmaker producing prototypes, I like to stay close to the cutting action. That's why I enjoy working directly at the machine."



Fabian Schweizer is enthusiastic about the OCM cycles and the integrated cutting data calculator.

PRECISION AT THE PUSH OF A BUTTON

Since the machines in the toolmaking department are not in continuous operation, a calibration process using the KinematicsOpt software option is performed regularly before new jobs are started. For this purpose, a calibration sphere is mounted at any position on the machine table and measured using a HEIDENHAIN touch probe. Based on the recorded measurement data, the TNC determines the machine's static tilting accuracy and compensates for any deviations. This ensures consistently high machining accuracy over the long term.



With KinematicsOpt, the machine kinematics are always perfectly calibrated.

ONE CONTROL, MANY STRENGTHS

Versatility makes the difference



The Klartext programming language of TNC controls is not only named after plain-language programming, it is built around that very principle.

Fifty years of TNC. For a technical product line to achieve this level of success, many factors have to come together. From HEIDENHAIN's perspective, the most important aspect is satisfied users.

This objective has guided TNC developers from the very beginning. After all, the goal is not simply to expand the capabilities of machine tools through technical innovation. As complexity continues to increase, new technologies must remain intuitive to operate and fully under the user's control at all times.

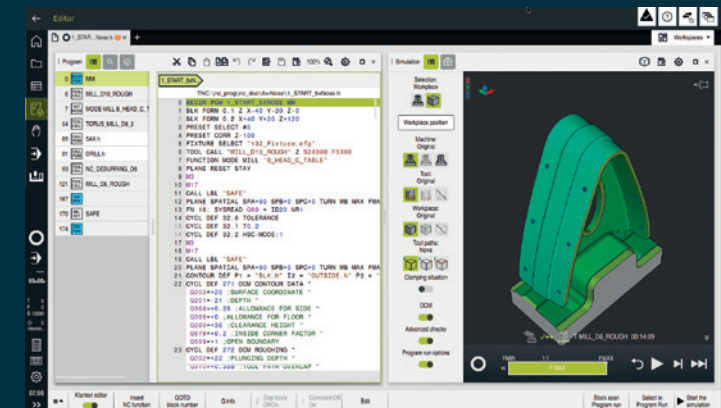
OPTIMAL MOTION CONTROL AND DRIVE PERFORMANCE

TNC controls are synonymous with superior surface quality and outstanding dimensional accuracy. This makes them ideally suited for demanding applications such as tool and mold making. Features such as the Dynamic Precision package, the control's Tool Center Point Management, and 3D Tool Compensation (known as 3D-ToolComp) are just a few examples. In combination with HEIDENHAIN motors, drives, and encoders, all of which are specifically designed for use in machine tools, TNC controls enable high-speed machining with maximum accuracy, even during highly complex 5-axis movements.

INTUITIVE OPERATION

The name says it all: the Klartext programming language of TNC controls is not only named after plain-language programming, it is built around that very principle. Instead of relying on cryptic codes, programs are created through a conversational interface using clear, easy-to-understand commands. This not only makes it possible to create NC programs directly at the machine, but also allows shopfloor personnel to incorporate their practical expertise right from the start of the programming process.

But the Klartext programming language is only one example of the user-friendliness that has become a hallmark of TNC controls. From soft keys and touch operation to HEIDI (short for HEIDENHAIN DIGITAL INTELLIGENCE)—the AI assistant that can even generate programming suggestions—control operation contin-



Graphical assistance: Features such as MAS simplify setup and help get the first chip flying more quickly.

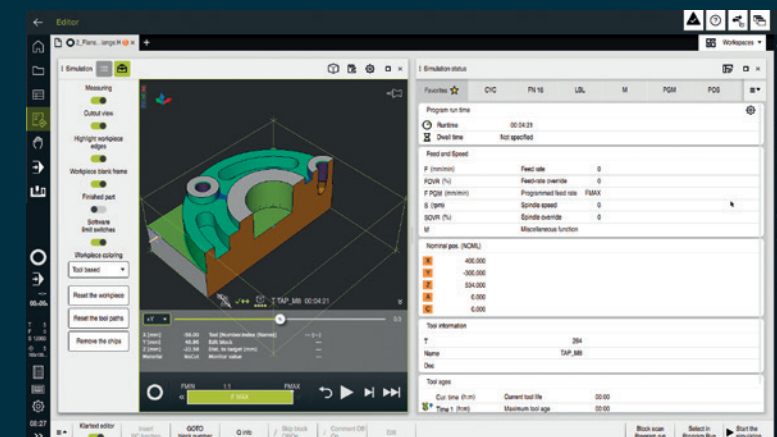
ues to evolve with a focus on maximizing ease of use. In fact, TNC controls are now even teaching robots to speak Klartext!

SAFETY YOU CAN COUNT ON EVEN BEFORE A CHIP IS CUT

Will the NC program run smoothly on the machine shop floor? The detailed, true-to-life simulation provided by TNC controls answers that question before machining begins, especially for programs created with CAM systems. Solutions such as HEIDENHAIN programming stations and a Digital Twin bring not only Klartext programming, but also realistic simulation and program verification to the PC in the office. So when the program reaches the shop floor, the machine can get straight to making those chips fly.

MAXIMUM RELIABILITY

"It's running!" The more often that phrase can be heard across the shop floor, the better. TNC controls provide the ideal foundation for making it happen: cycles that simplify setup, highly effective dynamic collision monitoring, and comprehensive monitoring functions for processes and for machine components. HEIDENHAIN also offers complementary solutions such as vision systems, breakage sensors, and State-Monitor, all of which integrate seamlessly with the control. This results in stable and efficient manufacturing processes, allowing the machine to focus on what it does best: producing high-precision workpieces economically, including during unattended shifts.



Realistic simulation: The preview even allows users to view a cross-section of the workpiece, enabling holes and slots to be evaluated before machining begins.



PROGRAM FASTER, MANUFACTURE MORE FLEXIBLY

How Schiele Maschinenbau uses the vTNC7 to produce prototypes and spare parts more efficiently

Schiele Maschinenbau GmbH specializes in the development and construction of coating systems for flooring, wood profiles, façade cladding, and window frames. One of the company's particular strengths is the loss-free application of coating materials. Excess material is recovered and reused within the coating process, thereby conserving resources and reducing material costs. Depending on the application, different coating methods are employed, including brush application (IMPREGMAT®), vacuum-assisted coating (VACUMAT®), and specially developed transfer discs (TransferDisc) in order to coat flooring elements that have chamfers and edges.

"The vTNC7 is a straightforward solution for small and medium-sized companies that do not require complex and expensive programming software."

Maik Schmitt

IN-HOUSE MANUFACTURING AS A STRATEGIC SAFEGUARD

The company's machines and systems are designed and assembled entirely in-house. While many components are sourced from external suppliers, Schiele also operates its own machine shop equipped with milling and turning machines.

"In theory, we could manufacture almost any part we need ourselves," explains Maik Schmitt, training manager and the person responsible for NC programming at the company. "Given our production volumes, com-



Completed programs are transferred quickly and easily via a USB stick.

plete in-house manufacturing would not be economical. However, if a customer's system goes down or we need a spare part on short notice, we can respond quickly. We also make extensive use of our machining capabilities for prototype development."

The importance of flexible NC programming becomes particularly evident in prototype manufacturing. New components often begin with an initial design and undergo multiple modifications during the development process. As a result, NC programs frequently need to be revised or created from scratch. This is where HEIDENHAIN's new vTNC7 programming system supports the company's in-house manufacturing operations, accelerating the path from concept to finished workpiece.

vTNC7 PROVES ITS VALUE IN PRACTICAL USE

Maik Schmitt first became aware of the vTNC7 at an industry event. The new programming system immediately caught his attention, primarily because it offered the potential to create NC programs much more efficiently and bring modern machining strategies to existing machines.

Until then, programming had been carried out both directly at the machine and at a separate PC workstation. Since the introduction of vTNC7, this process has changed noticeably.

"Programming is much faster today," Schmitt reports. "The optimized machining strategies in particular ensure that programs run more efficiently and that the machines can complete their tasks more quickly."

For him, one of the key advantages is access to the new milling cycles available through the vTNC7. One example is the Optimized Contour Milling machining strategy (OCM), which can even be used on older machines.

“Even though we are not a high-volume production operation, it makes a big difference whether a component requires five minutes or twenty minutes of machining time,” says Schmitt. “You notice those time savings immediately.”

BETTER SURFACE QUALITY, LESS REWORK

In addition to shorter machining times, Schiele benefits from improved machining quality. The modern milling strategies produce surface finishes that already meet the requirements directly after machining.

“The surface quality is excellent. In many cases, we can dispense with manual rework entirely,” explains Schmitt.

This advantage is particularly valuable in prototype manufacturing. When components require multiple design iterations, every rework step that can be eliminated reduces the overall effort involved. At the same time, new variants can be evaluated and tested more quickly.

AI SUPPORT DIRECTLY IN THE PROGRAMMING SYSTEM

Another benefit is provided by HEIDI, the AI assistant integrated into the vTNC7. Accessible through a dedicated workspace, it supports users throughout the NC programming process.



Using OCM makes workpiece machining significantly more efficient and, in most cases, eliminates the need for additional manual rework.

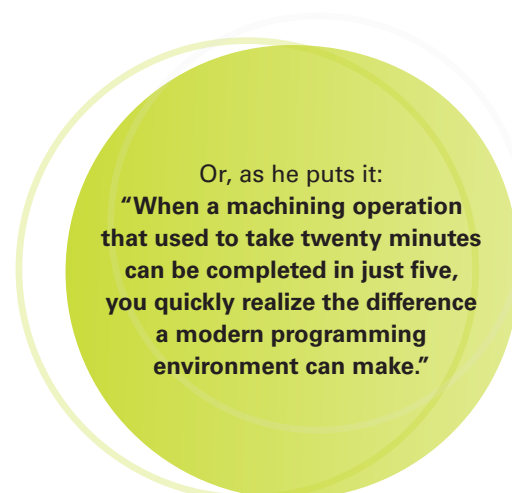
Instead of searching through manuals or documentation, Schmitt can ask questions directly within the system.

“Before I reach for the manual, I use the AI support integrated in the vTNC7,” he says. “HEIDI provides a solution suggestion very quickly and helps me find the right function or the appropriate programming approach.”

As a result, searching for information becomes significantly easier and users can become familiar with new functions more quickly.

GREATER FLEXIBILITY FOR DAY-TO-DAY OPERATIONS

Once completed, the programs are transferred to the respective machine at Schiele via USB sticks. For Maik Schmitt, the benefits of introducing the vTNC7 are clear: faster programming, modern machining strategies, and intelligent assistance directly at the workstation.



Maik Schmitt is thoroughly convinced of the benefits of the vTNC7 programming system.

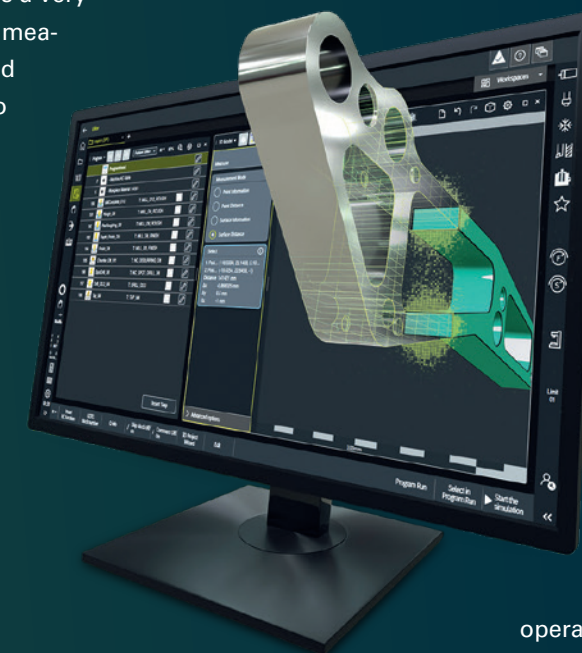
vTNC7 The programming system with AI

Digitalization, process reliability, and sustainability are key drivers shaping modern manufacturing. NC programming is evolving as well. At the same time, the creation and availability of NC programs remains a bottleneck in many shops, often leading to delays and idle time in the production process. As a result, solutions that enable efficient, reliable, and flexible programming are becoming increasingly important.

This is exactly where the new vTNC7 software solution comes in. It enables machine operators to program 2.5D components quickly, reliably, and directly within their familiar operating environment, without having to rely on external systems. The result is a very powerful programming system, meaning that valuable shopfloor and process expertise can be put to immediate use, while additional programming capacity is created. The benefits are shorter lead times, reduced machine downtime, and noticeably greater efficiency, all while maintaining maximum flexibility and control.

FEATURE-BASED PROGRAMMING

With Feature-Based Programming, the vTNC7 opens up a new dimension in NC programming. The programs are generated directly and intuitively from a component's 3D model, making programming faster, more reliable, and easier to use. At the same time, the vTNC7 systematically captures valuable process and manufacturing know-how. This information remains available for future use and can be incorporated into subsequent programs. The result is greater efficiency, increased standardization, and sustainable knowledge transfer throughout the organization.



The next level of NC programming: With the vTNC7 programming system from HEIDENHAIN, workpiece designs can be transferred from the office to the machine in the workshop even faster.

INCREASED EFFICIENCY FOR EXISTING MACHINES

With the new Klartext Converter in the vTNC7, modern Klartext programs can now also be used on older TNC controls. Cycles featuring complex motion sequences, infeed strategies, and pre-positioning movements are automatically translated into classic Klartext, ensuring compatibility with previous generations of controls.

This opens up new possibilities for your existing machinery. The functional scope of older machines can be expanded significantly, increasing their performance and extending their service life. At the same time, you benefit from the advantages of state-of-the-art programming technology without having to replace your existing investments.

AI-POWERED USER ASSISTANCE

With the new AI assistant HEIDI, HEIDENHAIN takes task-oriented user support to the next level. The assistant provides context-specific support with programming and

operating tasks, making it easier to access relevant information. For more information, see the “AI-powered assistance” article on page 13.

EXPANDED FUNCTIONALITY FOR AMB 2026

The capabilities of the vTNC7 will be expanded in time for AMB 2026. Two new machining strategies—face milling and contour milling—will further enhance the system's functionality. These additions broaden the application range of the vTNC7 and make fast, intuitive program creation even more powerful and versatile.



Theory becomes practice on modern machines in the spacious machine hall.

45 YEARS Technical Training at HEIDENHAIN

Practical, high-value training has a long tradition at HEIDENHAIN. For more than four decades, these training programs have been continuously refined and expanded, and today they are an essential building block for the successful use of HEIDENHAIN technology.

You can always find the
current training program
at [heidenhain.com/
technical-training](https://www.heidenhain.com/technical-training)

THE EARLY YEARS

The systematic development of HEIDENHAIN's training program began in 1981 with the establishment of the "Customer Service, Training, and Documentation" department. Initially, one single employee organized training courses for HEIDENHAIN dealers, providing knowledge on the application and repair of the TNC 121, TNC 125, and TNC 131 controls. In those early days, knowledge transfer relied on simple tools such as overhead projectors and transparencies. Regular TNC programming courses were introduced as early as 1982. These were initially aimed at machine manufacturers, who were expected to pass their knowledge on to their customers. In addition, field service and repair training courses were offered for HEIDENHAIN's own representatives.

GROWTH AND SPECIALIZATION

As TNC controls continued to evolve, the scope and complexity of the training content grew as well. The training portfolio expanded accordingly to include PLC programming courses for machine customization, commissioning training for control systems, user programming courses, and service training. At the same time, course durations increased significantly.

What had once been one-day classes evolved into multi-day training programs, a standard that remains in place today.

NEW TARGET GROUPS AND AN INTERNATIONAL FOCUS

In 1992, all training activities were consolidated within the Technical Training department. At the same time, the composition of course participants began to change, with users of the machine tools increasingly accounting for the largest share of attendees. As a result, practical and application-oriented requirements became an even greater focus of the training program. Today, the courses are designed for operators and programmers, commissioning engineers, PLC programmers, and service technicians working with encoders and controls.

As demand continued to grow, the training program was expanded internationally. TNC programming courses

are now offered worldwide in local languages through HEIDENHAIN representatives. Since the year 2000, authorized training partners have also delivered courses according to uniform HEIDENHAIN standards, ensuring consistently high-quality training around the globe.

A MODERN LEARNING ENVIRONMENT

A major milestone was the opening of the dedicated training center in 2012. With eight training rooms and a machine hall covering approximately 380 m², the facility enables a direct connection between theory and practice. Participants create NC programs at their individual workstations and then test them on actual machine tools. Modern machining centers provide realistic training environments for service and commissioning topics. The goal is to build confidence in the use of HEIDENHAIN products while ensuring the direct transfer of newly acquired knowledge to practical applications. The increasing complexity and capabilities of modern products, higher machine accuracy and machining speeds, growing safety requirements, advanced self-diagnostic functions, and the ongoing expansion of manufacturing technologies continue to drive demand for training and support among our customers. As a result, the training program is continuously adapted to meet these evolving requirements.



The first TNC training classroom



Training today in one of HEIDENHAIN's seminar rooms

PRECISION For scanning the universe

The KLARTEXT team is back on the road again. This time, our journey takes us to a startup operating in a highly demanding environment: the manufacture of ultra-precision components for major scientific projects and the aerospace industry.

As we step into the new production hall of Black Forest RMS GmbH, the scent of fresh timber fills the air. Constructed using timber-frame technology, the building is still a work in progress. Tradespeople are putting the finishing touches in place, cables are being installed, and much of the equipment has yet to arrive. Yet amid this atmosphere of new beginnings stands the centerpiece of the operation: a brand-new HERMLE C 650 equipped with an HS flex heavy handling system and the latest TNC7 control, fully operational on the hall's pristine new floor. Although the relocation is still underway, the system is already up and running. The reason is simple: demand is high, and the first orders are already waiting.

WHEN MICRONS DETERMINE SCIENTIFIC SUCCESS

Black Forest RMS GmbH develops and manufactures high-precision aluminum and steel components as well as precision mirror surfaces. Over the coming years, the international ngVLA project (Next Generation Very Large Array) will see the installation of a total of 244 radio telescopes with diameters of 18 meters, and another 19 antennas with six-meter dishes, distributed across a distance of more than 8,000 kilometers.

Black Forest RMS manufactures the highly precise panels for the telescopes' subreflectors. These panels collect and focus the signals received by the telescopes and therefore must be produced to significantly tighter tolerances than the primary reflector panels, which are manufactured using a specialized forming process. The rule is simple: the higher the frequencies that must be received, the more precise the reflective surface needs to be. And that is where the challenge begins.

FROM 200 KILOGRAMS DOWN TO EIGHT

In front of us lies a massive aluminum block weighing approximately 200 kilograms. After about four hours of machining, the machine produces a finished component weighing just eight kilos. The real achievement, however, is not the amount of material removed, but the level of precision attained. The finished panels achieve a form accuracy of less than three microns RMS. With complex freeform 3D surfaces featuring a mirror-like finish, even the slightest irregularity becomes visible.

The goal is nothing less than to raise precision in the manufacture of aluminum mirror surfaces to a level that has never been achieved before.

WHEN ULTIMATE MACHINE ACCURACY ALONE IS NOT ENOUGH

The foundation of manufacturing at Black Forest RMS is a highly accurate machine tool paired with a high-performance HEIDENHAIN control. To achieve the level of precision required, the company additionally relies on a proprietary software-based error compensation process that is continuously refined and optimized. The system identifies process-related deviations and largely compensates for them through targeted corrections within the machining process. Following installation of the new machine, an initial test panel was manufactured and subsequently measured on a coordinate measuring machine. The deviations identified were already within a range that would be considered exceptionally precise for many industrial applications. For the demanding accuracy requirements at Black Forest RMS, however, they still provided an opportunity for further fine-tuning.

After consulting with the machine manufacturer, the HEIDENHAIN Helpline was brought into the project. "That's where you'll find people who truly know what they're talking about," says process development engineer Gerd Strössner. What initially appeared to be an almost unsolvable challenge led to a surprisingly practical solution the very same day:

The 3D-ToolComp software option was activated to enable three-dimensional calibration of the workpiece touch probe. Direction-dependent trigger deviations of the probe are stored in correction tables and automatically taken into account during subsequent measurement operations. Looking ahead, the goal is to measure every panel directly on the machine. The resulting measurement data can then be used to continuously optimize the machining process and feed corrections back into production in a largely automated manner.



Gerd Strössner, process development engineer, appreciates the user interface of the TNC7.



On these high-gloss components, the machine's control performance becomes visible directly on the workpiece surface.

“The transition from the iTNC 530 to the TNC7 was much easier than expected.”

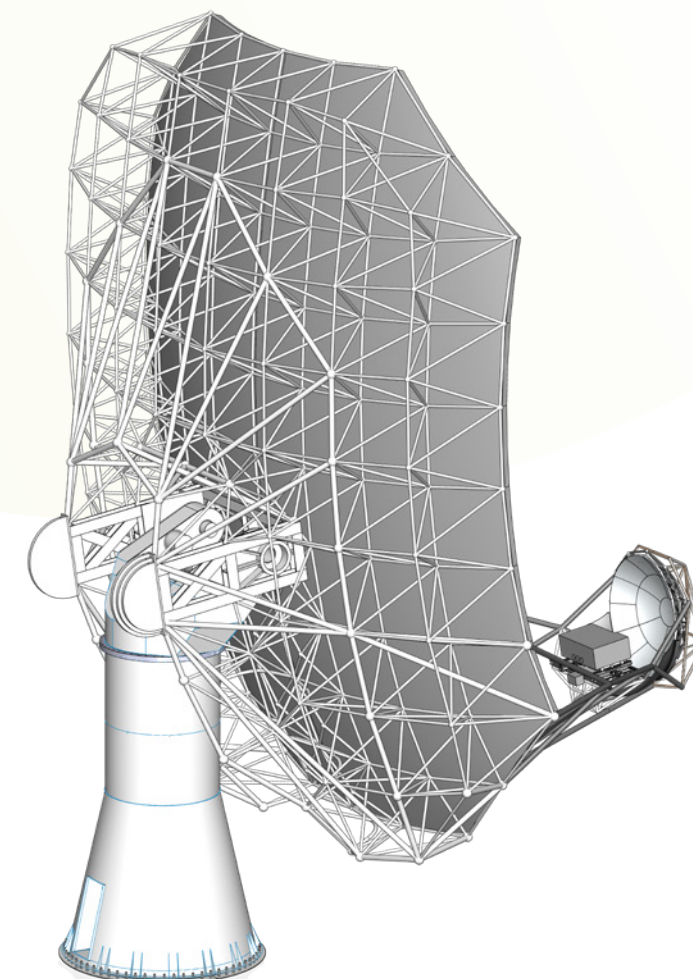
Gerd Strössner
Process Development Engineer

NEW MACHINE, NEW POSSIBILITIES

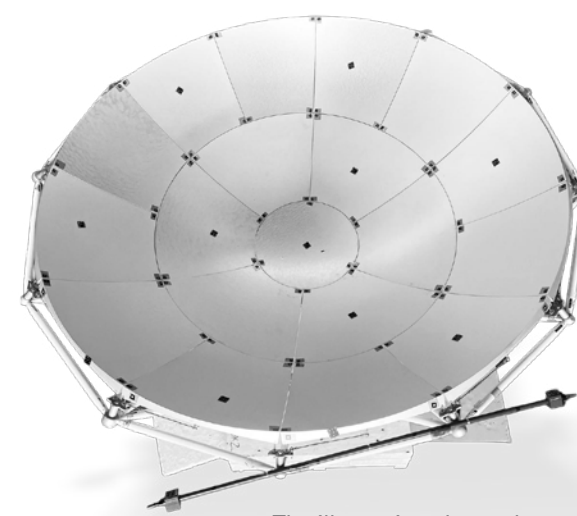
Gerd Strössner is responsible for programming. With his extensive experience in machining complex free-form surfaces, he immediately recognized the advantages of the new machine-and-control combination. For him, it represents a significant technological leap compared to the iTNC 530 previously in use.

“The transition from the iTNC 530 to the TNC7 was much easier than expected,” he reports. After receiving training from the machine manufacturer, he was able to get up to speed quickly.

Although the demanding components are programmed entirely using a CAM system, Strössner appreciates the expanded capabilities of the TNC7, particularly when it comes to highly dynamic machining processes and the control's comprehensive measurement and compensation functions. The intuitive touchscreen operation, including smooth zooming of complex workpieces, is another feature that has made a strong impression.



The telescopes for which these panels are manufactured using HEIDENHAIN controls also rely on HEIDENHAIN exposed linear encoders for positioning.



The illustration shows the subreflector of the radio telescope.

AUTOMATION WITH A SENSE OF PROPORTION

Production at Black Forest RMS is strategically geared toward growth. The company's goal is a highly automated manufacturing environment with minimal staffing requirements, supported by seamlessly integrated logistics and automation processes. The move into the new production facility has laid the foundation for that vision. Additional machine capacity has already been planned, and the infrastructure provides ample room for future expansion.



THE TNC7 GROWS WITH ITS TASKS

With new functions and expanded technologies, the TNC7 continues to evolve. From workpiece alignment to done-in-one machining, it opens up additional possibilities for a wide range of manufacturing applications and supports users in numerous day-to-day tasks. The result is shorter setup times, greater process reliability, and new opportunities for efficient machining strategies.

At the same time, the TNC7 is evolving into a family of controls designed for different machine concepts. The TNC7, TNC7 basic, TNC7 select, and TNC7 go variants all follow a common operating philosophy while offering function sets tailored to their respective fields of application. The following innovations provide insight into recent enhancements and their practical benefits.

RELIABLE PROCESS MONITORING

With software version 21, the existing process monitoring capabilities of the TNC7 are being enhanced with an intelligent recommendation system. The system automatically suggests appropriate monitoring settings and incorporates additional data from the simulation environment. In this way, it helps users identify tool and process deviations at an early stage. The recorded process data can be visualized directly on the 3D tool path,

allowing loads, material removal, and potential deviations to be identified at a glance. As a result, process monitoring becomes not only more powerful, but also easier to understand and significantly simpler to use.

MORE EFFICIENT SETUP

Setting up complex workpieces is one of the most time-consuming steps in the manufacturing process. With the probing functionality of the Model Aided Setup (MAS) option, the TNC7 supports the precise alignment of workpiece blanks and semi-finished parts in all six degrees of freedom. The guided workflow reduces setup effort, minimizes potential sources of error, and speeds up the entire setup process.

GREATER CONFIDENCE DURING PROVE-OUT

When proving out new NC programs, the OC 310 override controller assists users with a well-designed operating concept. Its endlessly rotating control knob, haptic feedback, and conditional stops at predefined program points keep the user fully in control of program execution at all times. This makes it possible to identify and avoid potential errors already during the very first program run.

DETECTING COLLISIONS EARLIER

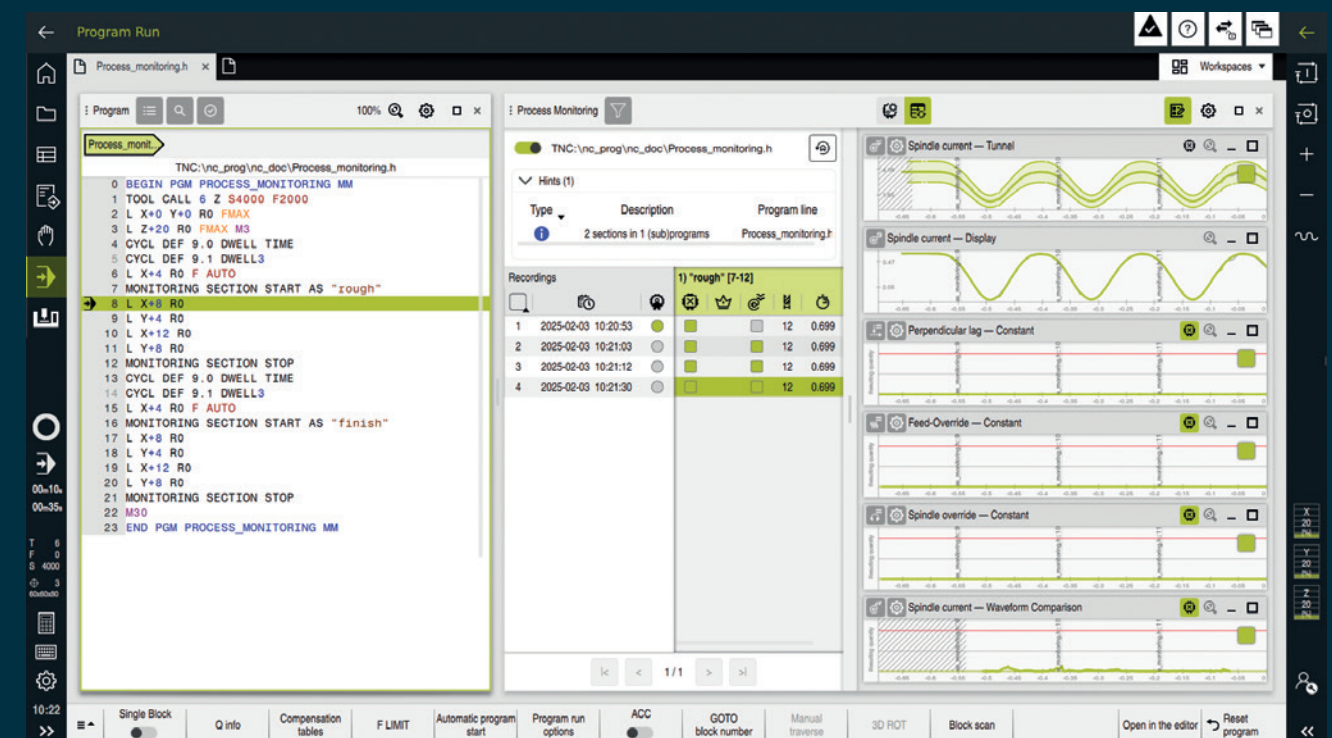
New functions within Dynamic Collision Monitoring (DCM) enable even more realistic simulation of complex fixturing situations. In addition to multiple fixtures, multiple workpieces can now be displayed simultaneously in the simulation and checked for potential collisions. The result is a much more accurate representation of multi-part setups, providing an additional level of safety before machining even begins.

AUTOMATION WITHOUT ROBOTICS EXPERTISE

Integrated handling robots are increasingly taking over tasks such as loading and unloading workpieces in manufacturing environments. However, the move toward automation is often hindered by the additional programming effort and specialized expertise required. HEIDENHAIN simplifies this step through direct integration into the TNC. Robots are programmed and operated via the familiar user interface, while Klartext cycles and teach-in functions make them easy to use. Ethernet connectivity also enables straightforward integration, including on existing machines.

NEW MACHINING POSSIBILITIES

The TNC7 brings together multiple manufacturing technologies within a single control environment. Milling, drilling, turning, and grinding are complemented by processes such as skiving and shaping. All of these operations can be programmed, simulated, and combined within the same environment. Shaping in particular opens up new possibilities. Sophisticated geometries and high-quality surface finishes can be produced economically in applications where conventional milling methods reach their limits or would require significantly greater effort.



KLARTEXT

DIE TNC-ZEITUNG

MÄRZ '83

AUSGABE 1

Warum diese Zeitung?

KLARTEXT ist eine Zeitung für den Mann an der Werkzeugmaschinen. Und besonders für den Maschinenwerker, der mit TNC-Steuerungen arbeitet. KLARTEXT kann man nicht für Geld bekommen, KLARTEXT will nicht werben oder verkaufen. KLARTEXT ist kostenlos. KLARTEXT will nicht nur unterhalten, sondern auch unterrichten. KLARTEXT will Ihnen, den Maschinenwerkern, mitteilen, was die TNC-Steuerung heute ist, was sie kann, was sie nicht kann, was sie werden will. KLARTEXT will Ihnen, den Maschinenwerkern, mitteilen, was die TNC-Steuerung heute ist, was sie kann, was sie nicht kann, was sie werden will.

Wie oft schütteln wir im täglichen Umgang mit Geräten, Maschinen und Werkzeugen den Kopf, weil entweder die Handhabung umständlich ist oder bestimmte Funktionen sinnlos erscheinen. Hand auf's Herz! Gehen Sie zu einer TNC-Maschine, die Ihnen bei der Einarbeitung es nicht auch so. "So ein Blödsinn!" werden Sie oftmals gedacht haben. Und dann sollten wir das wissen, um den Blödsinn aus der Welt schaffen zu können.

Anderserseits wird das eine oder andere oftmals erst verständlich, wenn man durchblickt und die Zusammenhänge erkennt. Und dann wollen wir Ihnen leichtern, damit die Lernphase so kurz wie möglich bleibt. Das ist nun auch der Grund, warum TNC-Steuerungen mit Ihnen im "Klartext" korrespondieren. Sie müssen nicht erst eine Computer-Sprache lernen mit Ihrer TNC-Maschine vertraut. Ihr technisches Wissen und gerade das Arbeitsverhalten erleichtern. Nicht deswegen

ist jemand heute ein guter Mitarbeiter, weil er den Herstellungsprozess einer Feile herbeibringen kann, so wie er das einmal als Lehrling gelernt hatte. Und ebenwelche heute das Auto mit unsynchronisiertem Getriebe, mit dem das Runterschalten nur mit Zwischengas ging – wer erinnert sich noch? – kein idealer Fahrer.

Nein, der technische Fortschritt und der Kampf um die Aufträge jeder Branche erfordern heute in der Welt höchste Flexibilität und Anpassungsfähigkeit. Vom Chef, aber auch vom Mann an der Maschine, dauert es, bis man an einer neuen Maschine Späne machen kann, das allein ist in vielen Betrieben die entscheidende Frage da nicht eine Steuerung sollte helfen. Eine Steuerung, die sich an der Maschine anpasst, was sie tun lässt, was sie tun soll. Damit dieses Kennenlernen von Maschinenwerkern und Steuerung

schnell geht, spricht die Steuerung Klartext, so wie man es versteht, auch ohne vorherigen (Programmier-) Sprachkurs. Deshalb Klartext-Programmierer der TNC's und deshalb der Name KLARTEXT für diese Zeitung. Und da man bekanntlich nie auslernt, wollen wir mit KLARTEXT Tipps und Anregungen für den Umgang mit TNC-Steuerungen geben – auch für die, die schon fast alles wissen. Wir werden auf dem neuesten Stand der TNC-Entwicklung, über Anwendungs-Erfahrungen, Verbesserungen und Überhaupt über alles das zum Thema TNC berichten, was Sie interessieren könnte, ohne daß Sie es wissen müssen. Sehen Sie sich die erste Ausgabe von KLARTEXT einmal an. Schreiben Sie uns, wenn wir Ihnen die nachfolgenden Nummern kostenfrei zusenden sollen. (Anforderungscoupon Seite 4)

Vom Zähler VRZ zur Steuerung TNC

Genaue Wegmeßsysteme gehören wohl zu den wichtigsten Elementen. Sie stellen und stellen einen Schwerpunkt des HEIDENHAIN-Programms dar. Als seinerzeit die auf dem Markt verfügbaren elektronischen Zähler als Positionsanzeigen für hochauflösende Wegmeßsysteme einfach zu langsam waren sah sich HEIDENHAIN veranlaßt, selbst Zähler zu bauen und damit den Schritt von Feinmechanik und Optik zur Elektronik zu tun.

Der Bedarf an preisgünstigen Steuerungen, die dem Werker an Bohr- und Fräsmaschinen bei seiner Arbeit helfen, öffnete der Firma HEIDENHAIN ein neues Feld. Die traditionellen Steuerungen für Bearbeitungszentren und Drehmaschinen und ließen den großen Bereich der einfachen Bohr- und Fräsmaschinen unberücksichtigt.

Bei mindestens 80 % der Bearbeitungsaufgaben genügt die schmale Firmenspanne. Hinzu kommt, daß kleinere Firmen über keine ausgefeilte NC-Organisation verfügen; für diese Firmen ist es also notwendig, daß Bearbeitungsprogramme an der Maschine erstellt werden können.

Diese Marktlücke wurde von HEIDENHAIN durch den Schritt von Positionsanzeigen zur Steuerung geschlossen. TNC bedeutet: Bei diesen Steuerungen werden Bearbeitungsprogramme im allgemeinen "eingegeben", eben "eingeschrieben".

Die Steuerungen dieses Typs wurden 1976 ausgeliefert: die TNC 110. Diese Steuerung wurde weiterentwickelt

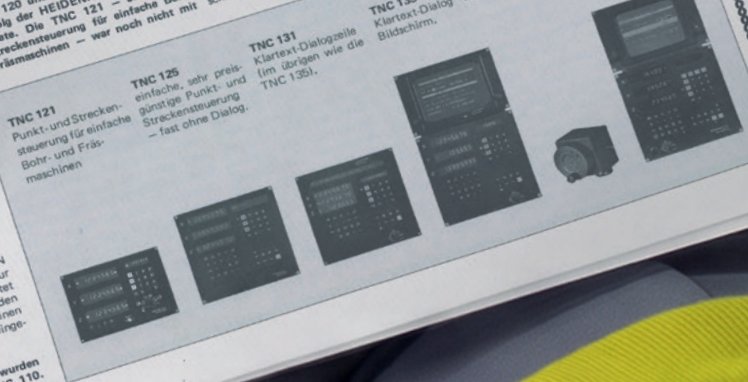
zur TNC 120 und dann zur TNC 121, die den Erfolg der HEIDENHAIN-Steuerungen begründete. Die TNC 121 – eine Punkt- und Streckensteuerung für einfache Bohr- und Fräsmaschinen – war noch nicht mit

der komfortablen Bedienungsführung ausgestattet wie die späteren TNC's, aber sie war relativ einfach zu programmieren und zu bedienen und war eben eine preisgünstige Maschinenbediener-NC.

Die TNC 121 wurde nach 3 Jahren abgelöst durch die Steuerungen TNC 125, TNC 131 bzw. TNC 135. Die Punkt- und Streckensteuerung TNC 131 bzw. TNC 135 waren die ersten TNC's mit Klartext-Dialogführung. Diese Art der Programmierung an der Maschine bot für den Maschinenbediener eine

wesentliche Erleichterung. Durch die Klartext-Programmierung wurden erstmals Programmierplatzfunktionen an die Maschine verlagert. Die Erstellung von Programmen an der Maschine wurde wesentlich vereinfacht, die Fehlerhäufigkeit wurde reduziert.

Dieser Steuerungstyp wurde konsequent weiterentwickelt zur Bahnsteuerung TNC 145 (erstmalig vorgestellt auf der EMO in Hannover im Jahre 1981). Komplizierte Konturen, die sich aus Geraden und Kreisbögen zusammensetzen, können mit Hilfe der Klartext-Dialogführung der TNC 145 vom Maschinenbediener direkt an der Maschine programmiert werden.



Der Nasenbohrer



2.



Die Firma DR. JOHANNES HEIDENHAIN wird von Anfang an maßgeblich an der Entwicklung hochwertiger optischer elektronischer Längen- und Winkelmeßgeräte beteiligt. Das verhalf ihr zu führenden Positionen in diesem Gebiet der Feinmechanik. Besonders bemerkenswert ist die Entwicklung der TNC-Steuerung. Seit 20 Jahren ist HEIDENHAIN in der Entwicklung von Längen- und Winkelmeßgeräten tätig. Seit 1976 wird die TNC-Steuerung in der Entwicklung von Längen- und Winkelmeßgeräten eingesetzt. Seit 1981 wird die TNC-Steuerung in der Entwicklung von Längen- und Winkelmeßgeräten eingesetzt.

HISTORIC DOCUMENT

The first issue of KLARTEXT was published in 1983. Back then, it still appeared in newspaper format, but already featured a retrospective on the history of TNC controls.